PROBABILITIES IN BRIDGE

ASSUMING DECK WELL SHUFFLED

NO. OF POSSIBLE 13 CARD HANDS FROM 52 CARD DECK = 635 013 559 600

HAND WITH:	PROBABILITY OF 1 IN:
13 CARD SUIT	158 753 400 000
12 CARD SUIT	313 123 000
11 CARD SUIT	2 746 694
10 CARD SUIT	60 738
9 CARD SUIT	2 699
8 CARD SUIT	214.2
7 CARD SUIT	28.36
1 OR 2 6 CARD SUITS	6.04
5 HIGH OR J LOW	1 133 953 000
6 HIGH OR 10 LOW	8 251 000
7 HIGH OR 9 LOW	262 551
8 HIGH OR 8 LOW	18 170
9 HIGH OR 7 LOW	2 049
10 HIGH OR 6 LOW	323.4
J HIGH OR 5 LOW	65.31
JUST 2 SUITS	10 176
JUST 3 SUITS	19.58
4 ACES	378.6
4 ACES & 4 KINGS	585 000
4 ACES & 3 KINGS	22 500
150 SUIT HONORS	505

COUNT A=4 K=3 Q=2 J=1

PROBABILITY OF COUNT OF	0	THRU 2	= 0.02508
" " " "	3	" 5	= 0.11494
" " " "	6	" 8	= 0.23474
" " " "	9	" 11	= 0.27706
" " " "	12	" 14	= 0.20635
" " " "	15	" 17	= 0.10096
" " " "	18	" 20	= 0.03285
" " " "	21	" 23	= 0.00700
" " " "	24	" 26	= 0.00094
" " " "	27	"	= 0.00008

SUIT PATTERN PROBABILITIES

EX: THE FIRST IS FOUR OF ANY ONE SUIT AND THREE IN EACH OF THE OTHERS

SUIT PATTERN OF HAND:	EXPECTED NO. OF SUCH HANDS IN 1000
4333	105.36
4432	215,51
4441	29.93
5332	155,17
5422	105,80
5431	129.31
5440	12.43
5521	31.74
5530	8,95
6322	56.42
6331	34.48
6421	47.02
6430	13,26
6511	7.05
6520	6.51
6610	0.72
7222	5,13
7321	18.81
7330	2.65
7411	3,92
7420	3,62
7510	1,09
7600	0.06
8221	1.92
8311	1,18
8320	1,09
8410	0,45
8500	0.03

PROBABILITIES IN DRAW POKER

Original Hand (Deck Assumed well Shuffled)

Probabilities expressed as one hand in so many (on the Average)

KIND OF HAND	REGULAR 52 CARDS	JOKER WILD (53)	DEUCES WILD (52)	DEUCES & JOKER WILD (53)
FIVE OF A KIND		220,745	3868	1912
ROYAL FLUSH	649,740	119,570	5370	3174
STRAIGHT FLUSH	72,193	15,943	1257	787
FOUR OF A KIND	4,165	920	82	56
FULL HOUSE	694	438	205	191
FLUSH	509	368	180	151
STRAIGHT	255	140	42	34
THREE OF A KIND	47	21	7.3	6.3
TWO PAIRS	21	23	27	30
ONE PAIR	2.4	2.3	2.1	2.1
BLANK HAND	2.0	2.2	3.3	3.6

PROBABILITIES ON THE DRAW (NOTHING WILD)

Flushes

Holding 4 of a suit, discarding 1, EX 3♥, 6♥, Q♥, K♥, 3♣,
Any of 47 different unseen cards could be drawn
Only 9 different cards complete Flush, A-2-4-5-7-8-9-10-J♥
Probability of filling flush = 9/47 or 1 in 5.2

Straights

Outside straight of 4 cards and 1 odd,- 3♣, 4♥, 5♥, 6♣, J♦
Useful cards 2♠, 2♣, 2♥, 2♦, 7♥, 7♦, 7♠, 7♣
Probability of filling outside straight 8/47 or 1 in 5.9
Inside straight of four and 1 odd,- 3♠, 4♠, 6♣, 7♦, J♦
Useful cards 5♠, 5♣, 5♥, 5♦
Probability of filling inside straight 4/47 or 1 in 11.8

Two Pairs

Holding two pairs & odd card Ex. J , J , 3 , 3 , 8
Any of 47 different unseen cards could be drawn
Only 4 different cards improve the hand
Probability of full house - 4/47 or 1 in 11.8

Threes

Threes & Kicker, Ex. Discarding 2♠ from 2♣, 4♥, 4♦, 4♣, A♥
Useful cards 4♠, A♣, A♠, A♦,
Probability of fours = 1/47 of a full house = 3/47
Threes alone, Ex. Discard both 2♠, A♥, above.
There are 1081 possible combinations of 2 cards. Any of 46 cards could come with 4♠, or 66 - possible pairs.
Probability of fours = 46/1081, or 1 in 23.5
Probability of a full house = 66/1081, or 1 in 16.4

JUMBO MARTINI PROBLEM

Premium Gin costs $5.20 a 5th
Cheap Gin costs $2.60 a 5th
Premium Vermouth costs $3.90 a 5th
Cheap Vermouth costs $1.30 a 5th
There are 26 oz. in a 5th

You plan to sell jumbo Martinis (5 oz.). You know from past experience that due to liquor controls you can only obtain certain quantities of liquor each week and you will have to keep ordering the same amounts to make the local political boss stop annoying you.

The most you can obtain is 2600 oz. of cheap gin, 500 oz. of premium gin, 400 oz. of cheap Vermouth, and 1000 oz. of premium Vermouth each week.

You want to know how to mix your martinis in order to maximize profits. If you use cheap gin and cheap Vermouth you will charge .40 per drink. If you use cheap Gin and premium Vermouth you will charge .70 a drink. If you use premium Gin and cheap Vermouth you will charge .80 a drink. If you use premium Gin and premium Vermouth, you will charge $1.10 a drink.

For the .40 drink you use 2 oz. Gin and 3 oz. Vermouth.

For the .70 drink you use 3 oz. Gin and 2 oz. Vermouth.

For the .80 drink you use 3 oz. Gin and 2 oz. Vermouth.

For the $1.10 drink you use 4 oz. Gin and 1 oz. Vermouth.

From past experience, you know you can sell up to 100 drinks containing cheap gin, up to 200 drinks containing premium Gin, and up to 150 drinks containing cheap Vermouth.

How much of what do you buy and what do you sell in order to maximize profit? What is the maximum profit?

(Note: Assume you can purchase any number of oz's of the liquor - not necessarily an even number of 5'ths).

ORDNANCE MANAGEMENT ENGINEERING TRAINING PROGRAM
COURSE: MATHEMATICAL PROGRAMMING

NUT MIX PROBLEM

A manufacturer wishes to make three mixtures of cashews, hazel nuts, and peanuts in such a manner that he makes the most profit. The mixtures should conform to the following specifications:

MIXTURE		SELLING PRICE
A	Not less than 50% cashew and not more than 25% peanut	$ .50
B	Not less than 25% cashew and not more than 50% peanut	.35
D	No specified percentages. Hazel nuts may be introduced into any mixture in any amount, providing specifications are met.	.25

Due to the supply problems, the manufacturer can only obtain cashews, peanuts, and hazel nuts at the rate of 100, 100, and 60 lbs. per day respectively. The respective purchasing costs per lb. are 65¢, 25¢ and 35¢. Find the combination of nuts in the mixtures which will maximize profit.